TRANSLATION

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Title:	Lubricating and disinfectant solution for container-conveying chains in the food industry, and application process.
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ABSTRACT:

Lubricating and disinfectant solution for container-conveying chains in the food industry, characterized in that it contains an effective quantity of at least one ether-amine with either of the following formulae:

$$(1)\ R\text{-}O\text{-}(CH_2)_3\text{-}NH_2$$

or

$$(2)\ R\text{-}O\text{-}(CH_2)_3\text{-}NH(CH_2)_3\text{-}NH_2,$$

where R stands for a saturated or unsaturated alkyl chain, branched from C_6 to C_{21}.

SPECIFICATION

This invention concerns a lubricating and disinfectant solution for container-conveying chains in the food industry.

It further concerns a process for the use of said solution, as well as the concentrate from which it is obtained.

The solution according to the invention has special application to the lubrication of bottle conveyor chains (or conveyor chains of other packaging materials) in the various beverage industries (e.g. breweries, mineral waters, fruit juices, wine, etc.).

In that type of industry, bottles or other containers are transported, before or after filling, by conveyor chains, most of which are made of stainless steel. Said conveyor chains are treated, either continuously or at periodic intervals, with lubricating solutions.

Said solutions are usually obtained from concentrates, which are diluted with water to very weak concentrations, of the order of .2% to 1% by weight. They are then applied to all conveyor chains in the facilities by sets of spraying nozzles.

The lubrication thus obtained allows bottle conveyor chains at bottling facilities to reach high gliding speeds, of up to 60,000 bottles per hour or more.

Some of the previously known solutions are soap-based or potassium-based, or use another substance which makes them sensitive to the hardness of the water. Insufficient quantities of sequestering agents in the solution cause the formation of calcium soap, which eventually clogs the lubrication solution pipes and thus interferes with the gliding motion of the bottles, necessitating frequent cleanups.

By their nature, solutions of that type also form an excellent substrate for the growth of bacterial and other microorganism on the conveyor chains. The formation of slime is frequently observed between the links and under the conveyor chains, which adds to the need for frequently difficult clean-up jobs.

The gradual improvement of hygiene in the food industry in general, and in the beverage industry in particular, has led to the development of solutions of that type which do not necessitate frequent cleanups and which prevent the proliferation of microorganisms.

Among them are the solutions described in European patents EP-A- 0,372,628 and EP-A-0,384,282, which suggest adding fatty alkylamines (in the first case) or secondary and/or tertiary amines (in the second case) to the solutions of the type under discussion.

The use of anionic or non-ionic surfactants to prevent the formation of calcium soap has been suggested in European patent application EP-A- 0,044,458.

To respond to ever more demanding user requirements, the filant company engaged in further research, with the objective of developing a solution of the type under discussion which would meet, even better than existing products, all the wishes of the end users with respect to minimizing conveyor downtime for clean-up operations or eliminating it altogether, and achieving total control of microorganism proliferation.

The filant company has demonstrated that this was an attainable objective, i.e., that it was possible to combine conveyor lubrication and disinfection operations without any clogging side effects, thus preventing slime formation, while at the same time limiting the number of cleanups to a minimum and obtaining high-speed gliding performances, simply by adding to the solutions applied as indicated earlier an effective amount of alipathic ether-amine with either of the following formulae:

$$(1)\ R\text{-}O\text{-}(CH_2)_3\text{-}NH_2$$

or

$$(2)\ RO\text{-}(CH_2)_3\text{-}NH(CH_2)_3\text{-}NH_2,$$

where R stands for a saturated or unsaturated alkyl chain, branched from C_6 to C_{21}.

Consequently, the lubricating and disinfectant solution according to the invention is characterized in that it contains an effective quantity of at least one ether-amine with either of the following formulae:

$$(1)\ R\text{-}O\text{-}(CH_2)_3\text{-}NH_2$$

or

$$(2)\ RO\text{-}(CH_2)_3\text{-}NH(CH_2)_3\text{-}NH_2,$$

where R stands for a saturated or unsaturated alkyl chain, branched from C_6 to C_{21}.

The lubrication and disinfection process for container-conveying chains in the food industry is characterized in that one applies to such a chain a lubricating and disinfectant solution according to the invention which contains an effective quantity of at least one ether-amine with either of the following formulae:

$$(1)\ R\text{-}O\text{-}(CH_2)_3\text{-}NH_2$$

or

$$(2)\ RO\text{-}(CH_2)_3\text{-}NH(CH_2)_3\text{-}NH_2,$$

where R stands for a saturated or unsaturated alkyl chain, branched from C_6 to C_{21}.

In a preferred embodiment of the solution according to the invention, in order to improve water solubility as well as lubricating and disinfecting performances, the formula (1) or (2) ether-amine is partially or totally neutralized up to a pH of 5 to 9 (preferably from 6 to 8) either by an organic acid such as an acetic, hydroxy-acetic, gluconic, lactic, or benzoic acid, or a C_8 to C_{20} fatty acid such as copra fatty acid or oleic acid; or else by a mineral acid of the group

which includes phosphoric acid and hydrochloric acid. Neutralization will be preferably effected by acetic acid or by gluconic acid.

In another preferred embodiment, the solution according to the invention contains a surfactant (preferably non-ionic) chosen from among those which generate little or no foam.

Such a surfactant improves the cleaning performance of the solution while making its formulation easier.

In another preferred embodiment, for easier formulation and fewer aging problems, the solution according to the invention contains a water-soluble solvent chosen from among the short-chain alcohols from C_1 to C_8 (preferably from C_2 or C_3), particularly ethanol, n-propanol or isopropanol, or from among the group which include propylene-, dipropylene- or tripropylene-glycol methyl ether, ethyl ether, butyl ether or phenyl ether, as well as ethylene or diethylene glycol ethers of the same types, particularly those which are known under the brand names of NAPSOL (BP Chemicals) and DOWANOL (Dow Chemical).

In another preferred embodiment, the solution according to the invention includes disinfectant additives which act on specific bacterial strains, as well as viscosity-controlling agents and coloring agents.

In another preferred embodiment, the solution according to the invention, prepared at a concentration of .2% to 1% by volume, contains at least one ether-amine of formula (1) or (2), and perhaps a surfactant and a water-soluble solvent.

The solution according to the invention can be marketed in the form of a concentrate defined by the following composition:

- ether-amine: 5% to 20% by weight, preferably 10 to 17%;
- surfactant producing little foam: 2 to 10 % by weight;
- alcohol- or glycol ether type solvent: 2 to 10 % by weight;
- water (in sufficient quantity to make up 100%).

The ready-to-use solution can then be prepared from said concentrate by adding an appropriate amount of water.

The dilution can be effected either with softened water (0 to 10° total hardness) or with hard water (e.g. 30° total hardness).

The following discussion highlights the advantages the solution according to the invention has over traditional soap-based solutions, i.e., its bactericide and yeasticide properties, the absence of any deposit formation during conveyor chain operation, the quality of the latter's gliding motion, and the lowering of COD (i.e., "chemical oxygen demand").

1. Bactericide and yeasticide effectiveness

This effectiveness has been demonstrated with a solution according to the invention which contained TOMAH-brand ether-amines (EXXON CHEMICAL Company).

Table I, below, gives the composition of four (A, B, C, D) solutions according to the invention, together with their pH and bactericide effectiveness in demineralized water, compared to two previously known products (Ref.1 and 2).

TABLE I

	A	B	C	D	Ref.1	Ref. 2
Isohexyloxypropylamine (TOMAH PA 10)	10	-	-	-		
Isodecyloxypropylamine (TOMAH PA 14)	-	10	-	-		
Isotridecyloxypropylamine (TOMAH PA 17)	-	-	10	-		
Isodecyloxypropyldiaminopropane (TOMAH DA 14)	-	-	-	10		
Acetic acid at 80%	4.8	3.7	3.1	5.7		
Glycol ethylene n butyl ether	8	8	8	8		
Water	-	-	to 100 %	-		
pH as is	6.0	6.0	6.0	6.0	8.9	8.7
Effectiveness on Saccharomyces Cerevisiae type yeast in demineralized water (per AFNOR NF T72 200)	.5%	.25%	.1%	.5%	>5%	>5%

Ref. 1 = Traditional commercial conveyor chain lubricant (based on 16% soap)

Ref. 2 = Same commercial conveyor chain lubricant + 1% fungicide (KATHON 886 brand, Rhöm and Haas).

Bactericide effectiveness has been confirmed in hard water for four other solutions according to the invention (E, F, G, H). See Table II, next page, for results.

TABLE II

	E	F	G	H
Isotridecyloxypropylamine (TOMAH PA 17)	10	10	10	15
Acetic acid at 80%	2.6	3.2	3.1	4.6
Glycol ethylene n butyl ether	5	5	5	5
Tridecylic 10 OE alcohol (LAUROXAL 10, Witco Chemical)	4	-	-	4
Lauric 20 OE alcohol (REMCOPAL 20, Gerland)	-	-	4	-
Water	-	-	to 100%	-
pH as is	8.0	6.0	6.0	6.0
Effectiveness on E. Coli in hard water (30° total hardness), per AFNOR NF T72 171	.25%	.25%	.25%	<.1%

2. Effectiveness at eliminating deposit formation

The advantages of solutions according to the invention as compared to previously known solutions, e.g. fatty amine-based solutions (patents EP-A-0,372,628 and US-A-4,839,067), are demonstrated by a test which determines the performances of .6% by volume solutions (both previously known and according to the invention) in demineralized water adjusted to 500 ppm sulfate ion content (for reference, industrial waters usually contain 50 ppm to 150 ppm sulfate ions).

The results are given in Table III, below.

TABLE III

Previously known, fatty-amine-based solution (oleyl-amine or propylene oleyl diamine type)	· Solution is very cloudy after 24 hours · Major deposits after 7 days.
Solution according to the invention, with fatty amine replaced by a TOMAH ether-amine	· Solution is cloudy after 24 hours · Cloudy, but deposit-free after 7 days.

It follows from the above results that nozzle clogging can be avoided by using solutions according to the invention.

3. Effectiveness with respect to gliding effect

The gliding effect contributed by lubricating solutions has been measured on a stainless steel pilot chain moving at .33 m/s, on which the resistance to gliding (expressed by index I) of a string of six bottles was tested (1-liter glass bottles, filled with water).

The six bottles in question were tied together by a rope attached to a dynamometer, which was itself connected to a plotting table and to a digital sensor (SEDEME-brand in the case of this example).

Index I is a number without unit value, which is meaningful only by reference to lubrication with water only.

The index equals zero when there is no pull on the dynamometer, at which point the sensor is calibrated to zero.

Next, the conveyor chain is lubricated with 30° total hardness water, which produces an index I reading of 5.5 on the sensor.

It was also noted that the interval between I=0 and I=5.5 corresponded to the entire scale of the paper on the plotting table. During subsequent testing of the various solutions, we

checked that the resulting values as shown on paper were indeed proportional to the numerical readings given by the sensor.

The lower the measured index, the smaller the friction and the better the gliding effect.

The test was carried out on the one hand on a previously known solution (Ref. 3), and on the other, on the solutions according to the invention mentioned earlier, i.e. C, D, F, G, and H. Ref. 3 solution and the solutions according to the invention were diluted in water, at a concentration of .6%.

Table IV, below, gives the results of the tests.

TABLE IV

Tested solutions	Index I
Ref. 3 (traditional commercial formula with appr. 16% soap)	1.45
C	1.45
D	1.45
F	1.50
G	1.30
H	1.50
without lubricating solution (water only)	5.50

The above table shows that the performance levels of the formulae according to the invention are similar to those of known, soap-based solutions.

4. Effectiveness with respect to CDO results

CDO, expressed in mg of oxygen per liter, was determined for two solutions at 1% by weight in water, obtained on the one hand from a concentrate according to the invention, and on the other from a previously known, soap-based concentrate.

The results of testing per AFNOR NF T 90-101 are summarized in Table V.

TABLE V

Previously known lubricating solution with appr. 16% soap	approximately 8500
Ether-amine-based lubricating solution according to the invention	3000 to 5000 depending on the solution

The above results demonstrate the advantage which solutions according to the invention have over previously known solutions. This particular advantage is important for making the products more environmentally friendly.

CLAIMS

1. Lubricating and disinfectant solution for container-conveying chains in the food industry, characterized in that it contains an effective quantity of at least one ether-amine with either of the following formulae:

$$(1)\ R\text{-}O\text{-}(CH_2)_3\text{-}NH_2$$

or

$$(2)\ RO\text{-}(CH_2)_3\text{-}NH(CH_2)_3\text{-}NH_2,$$

where R stands for a saturated or unsaturated alkyl chain, branched from C_6 to C_{21}.

2. Lubricating and disinfectant process for container-conveying chains in the food industry, characterized in that one applies to such a chain a lubricating and disinfectant solution which contains an effective quantity of at least one ether-amine with either of the following formulae:

$$(1)\ R\text{-}O\text{-}(CH_2)_3\text{-}NH_2$$

or

$$(2)\ RO\text{-}(CH_2)_3\text{-}NH(CH_2)_3\text{-}NH_2,$$

where R stands for a saturated or unsaturated alkyl chain, branched from C_6 to C_{21}.

3. Lubricating and disinfectant solution according to claim 1, characterized in that the ether-amine is partially or totally neutralized up to a pH of 5 to 9 (and preferably from 6 to 8) either by an organic acid such as an acetic, hydroxy-acetic, gluconic, lactic, or benzoic acid, or a C_8 to C_{20} fatty acid such as copra fatty acid or oleic acid; or else by a mineral acid from the group which includes phosphoric acid and hydrochloric acid.

4. Lubricating and disinfectant solution according to claim 1, characterized in that the ether-amine is neutralized by acetic acid or by gluconic acid.

5. Lubricating and disinfectant solution according to claim 1, characterized in that it contains a surfactant, (preferably non-ionic) chosen from among those which generate little or no foam.

6. Lubricating and disinfectant compound according to claim 1, characterized in that it contains a water-soluble solvent chosen either from among the short-chain alcohols from C_1 to C_8 (preferably from C_2 or C_3), of the group which includes ethanol, n-propanol or isopropanol, or from among the glycol ethers of the group which include propylene-, dipropylene- or tripropylene- glycol methyl ether, ethyl ether, butyl ether or phenyl ether, as well as ethylene- or diethylene glycol ethers of the same types, including those which are known under the brand names of NAPSOL (BP Chemicals) and DOWANOL (Dow Chemical).

7. Lubricating and disinfectant compound according to any of claim 1 or claims 3 to 6, characterized in that it is prepared to a concentration of .2% to 1% per volume, and that it contains at least one ether-amine of formula (1) or (2), and perhaps a surfactant and a water-soluble solvent.

8. Concentrate suitable for producing, when diluted with an appropriate amount of water, the lubricating and disinfectant solution according to claim 7, as defined by the following composition:

- ether-amine: 5% to 20% by weight, preferably 10 to 17%;

- surfactant producing little foam: 2 to 10 % by weight;
- alcohol- or glycol ether-type solvent: 2 to 10 % by weight;
- water (in sufficient quantity to make up 100%).